EPA Region V

RAC

Response Action Contract

# Frontier Hard Chrome
# Final Basis of Design Report
# Remediation Design—Vancouver, Washington
# Work Assignment Number: 134-RDRD-1027

EPA Contract: 68-W7-0026

January 2003

Weston Solutions, Inc. · 190 Queen Anne Avenue North · Seattle, WA 98109-4926

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# FINAL BASIS OF DESIGN REPORT
# FRONTIER HARD CHROME
# REMEDIATION DESIGN
# VANCOUVER, WASHINGTON

*Prepared for*

U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, WA 98101

Contract No.: 68-W7-0026
Work Assignment No.: 134-RDRD-1027
Work Order No.: 20064-134-100-1130
Document Control No.: RFW134-2A-AMKU

January 2003

*Prepared by*

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**FINAL BASIS OF DESIGN REPORT**
**FRONTIER HARD CHROME**
**VANCOUVER, WASHGINTON**

# 1. INTRODUCTION

The United States Environmental Protection Agency (U.S. EPA) issued a Statement of Work (SOW) to provide the remedial design for the Frontier Hard Chrome (FHC) Site located in Vancouver, Washington. The SOW required a Basis of Design Report to be developed which provides the technical approach and key assumptions for preparation of the design.

The Frontier Hard Chrome Site is located in the southwestern part of Washington State (Figure 1). The site is approximately one-half mile north of the Columbia River and covers about one-half acre. Frontier Hard Chrome is located at 113 Y Street, Vancouver, Washington. Soil and groundwater at FHC are contaminated with hexavalent chromium.

In late 2001, EPA issued a Record of Decision for cleanup of both soils and groundwater at the site. The Record of Decision identified in-situ treatment using reducing compounds as EPA's Preferred Alternative.

This document provides the bases for the design of EPA's selected remedy.

# 2. NATURE AND EXTENT OF CONTAMINATION

## 2.1 SOIL

A series of soil borings and monitoring wells have been installed on the site to characterize the contamination.

Surface soil samples were collected from numerous locations as part of the RI investigation (Dames and Moore 1987). In surface soils, total chromium was found in concentrations from less than 2 mg/kg to 5,200 mg/kg. Three samples were analyzed for soil hexavalent chromium and the results ranged from less than 0.5 mg/kg to 10 mg/kg. The highest surface soil concentrations occur near the drywell. However, an area directly north of the Frontier Hard Chrome building and another area at the east edge of the site also had elevated levels of total chromium.

Seven surface soil samples were analyzed using the EP Toxicity procedure. The seven samples had a range of 25 mg/kg to 5,200 mg/kg of total chromium, but only the sample with 5,200 mg/kg chromium yielded an EP Toxicity extract concentration above the detection limit with a concentration of 0.2 mg/L.

Subsurface soil samples were also collected from the site as part of the RI (Dames and Moore, 1987) and Remedial Design Studies (Radian, 1991; ICF Kaiser, 1993).

Chromium was also found throughout the site in subsurface soils at concentrations up to 17,000 mg/kg total chromium in the immediate area around the dry well. The depth of the most contaminated soils ranged to 20 feet below grade. Generally, the maximum chromium concentrations in soil borings occurred at the fill/clay interface that is present at depths of 15 to 20 feet across the site.

Additional soil characterization was performed in August 1999 (URS-Greiner 1999). The highest hexavalent chromium concentration detected was 7,000 mg/kg in the silt layer underneath the FHC building.

### 2.2 GROUNDWATER

Groundwater samples were collected from several on-site monitoring wells and geo-probes installed within study area. Groundwater samples were analyzed for metals, volatile organic compounds (VOCs), pesticides, PCBs and conventional water quality parameters.

The initial results of the RI showed that groundwater beneath the site contained significant concentrations of total and hexavalent chromium concentrations and that the chromium had spread beyond the boundaries of the site to the southwest. The highest concentration of total chromium detected was 300 mg/L (300,000 µg/L). Total chromium concentrations have generally declined since 1985. The highest concentration of total chromium detected in the 1997 sampling event was 19,400 µg/L (19.4 mg/L). The steady reduction of chromium concentrations suggests that significant attenuation of chromium concentrations by adsorption, dispersion, and dilution has occurred at the site.

The 1997 sample results indicated that, the hexavalent chromium concentrations averaged 97 percent of the total chromium concentrations. These results indicate that there is little significant difference between the hexavalent and total chromium values and indicate that all of the chromium present in groundwater is in the hexavalent form. This is not unexpected since the only other form of chromium, trivalent Cr(III), is only very-slightly soluble in water.

Additional groundwater characterization was performed in August 1999 (URS-Greiner 1999). The highest dissolved total chromium concentration detected was 119,000 µg/L underneath the FHC building.

## 3. PROJECT REMEDIAL OBJECTIVES

The ROD discussed several objectives for the remedial action for the FHC site. These objectives will form the basis for the design. The objectives for the design are:

- Contain the most heavily contaminated groundwater at the site. The groundwater that is most contaminated is referred to as the groundwater “hot spot” and is defined as groundwater exceeding 5,000 µg/L hexavalent chromium.
- Treat the soil source area and the groundwater hot spot in-situ. The soil source area is defined as soil exceeding 19 mg/kg hexavalent chromium.

# 4. DESCRIPTION OF SELECTED REMEDY

## 4.1 GROUNDWATER

The most heavily contaminated groundwater will be treated to reduce the concentration of hexavalent chromium prior to the groundwater moving off-site. Treatment will occur through construction of an in-situ treatment wall. Construction of the wall will involve injection of reducing compounds on the down-gradient side of the groundwater hot spot. The compounds injected into the aquifer will reduce the naturally occurring iron and create an in-situ treatment barrier. As chromium-contaminated groundwater moving down-gradient passes through the permeable reactive zone, the hexavalent chromium in the groundwater is reduced to trivalent chromium, which is insoluble, and non-mobile.

## 4.2 SOIL

Soil treatment will involve the delivery of reducing compounds directly to site source area through use of augers. Soil in both the vadose zone and saturated zone will be treated. Contact of the reductants with hexavalent chromium reduces the chromium to trivalent chromium which is less toxic and immobile. After the soil is treated, a soil stabilizing agent will be mixed with the soil to increase the soil's strength to allow light construction to occur in the area treated.

## 4.3 REMEDY PERFORMANCE STANDARDS

The soil remedy's performance standards will be to treat the majority of soil that exceeds a hexavalent chromium concentration of 19 mg/kg. Soil in the source area will be mixed with a reducing agent to convert hexavalent chromium to trivalent chromium. The source area will be the focus of the soil treatment remedy. Small quantities of soil outside the source area may exceed 19 mg/kg. Treatment of the source area may not include these outer areas as they contain relatively small quantities of hexavalent chromium compared to the source area and are not expected to adversely affect the overall performance of the remedy.

The groundwater treatment performance standard is to construct a treatment wall downgradient of the source area and capture the majority of groundwater that exceeds 5,000 µg/L. The groundwater treatment wall will be installed as far downgradient of the source area as practical to maximize the quantity of impacted groundwater contained. However, due to site limitations, groundwater exceeding 5,000 µg/L may exist downgradient of the treatment wall. The quantity of groundwater exceeding 5,000 µg/L is estimated to be small compared to that captured by the wall and will be left to naturally attenuate.

# 5. DESIGN ASSUMPTIONS

## 5.1 BUILDING DEMOLITION

### 5.1.1 Description of Work

Two buildings exist on site which will be demolished in support of source area treatment. These buildings consist of the former FHC Building and the Richardson Metals Building.

The former FHC Building and the Richardson Metals Building will be demolished to support treatment of the source area. These buildings underwent an asbestos survey prior to demolition. In addition, paint and concrete samples from both buildings were collected during the remedial action to determine if lead based paint was present and to determine the quantity of contaminated concrete requiring disposal in a hazardous waste landfill.

Utilities will be shutoff to these buildings and disconnected after the tenants vacate. A demolition contractor will demolish the buildings, concrete slabs and foundations. Pilings used to support the FHC building foundation will be removed. Demolition materials will be recycled as practical. Materials that cannot be recycled will be disposed in a landfill. Subsurface structures such as foundations will be removed.

### 5.1.2 Design Assumptions

Building Size and Construction—The Frontier Hard Chrome (FHC) Building is constructed of concrete masonry units (walls) and wood (roof). The building consists of an original structure with two additions. The original portion of the building covers an area of 2,450 square feet, is two stories high, and is approximately 18 feet in height. The first addition to the original structure covers an area of 2,000 square feet and consists of a single story with an approximate height of 16 feet. The second addition covers an area of 3,390 square feet and consists of a single story with a height of approximately 23 feet. The total area of the building plus the two additions is 7,840 square feet. The building's foundation consists of conventional concrete slab on grade and shallow spread footings. The second addition is an exception and is founded on piles along its north, east, and south walls. The piles are assumed to consist of 1-foot-diameter wood timbers installed at a spacing of 10 feet between piles; the length of the piles is assumed to be 25 feet. The building does not contain a basement.

The Richardson Building also consists of an original structure with two additions. The original structure was constructed of poured concrete (walls) and wood (roof). The structure covers an area of 550 square feet and consists of a single story with an approximate height of 10 feet. The first addition was constructed of wood and also has a wood frame roof. The addition covers an area of 2,590 square feet and consists of a single story with an approximate height of 10 feet. The second addition was constructed using steel beams with corrugated steel sheeting for walls and roofing. The addition covers an area of 6,020 square feet and consists of a single story with an approximate height of 25 feet at the roof's peak. The total area of the original building and the two additions is 9,160 square feet. The building's foundation consists of conventional concrete slab on grade and shallow spread footings. The building does not contain a basement.

Area and Mass of Contaminated Concrete—The mass of contaminated concrete classified as hazardous waste due to chromium contamination is approximately 220 tons based on concrete analyses. This mass represents one half of the FHC Building floor area with an assumed slab thickness of 6 inches, and also includes the internal building tank vent shaft (made of concrete). Contaminated concrete will be managed as hazardous waste and will be disposed of at Waste Management's Arlington, Oregon RCRA hazardous waste landfill.

In addition to the hazardous concrete, the FHC walls and remaining floor concrete contain concentrations of hexavalent chromium exceeding Washington State MTCA Method A standards (Table 740-1) and requires disposal in a non-hazardous waste landfill.

Concentrations of contaminants (metals, PCBs and TPH) in the Richardson Building concrete were low, and as a result, this concrete can be recycled.

Hazardous Materials Inventory—It is assumed that all hazardous materials (oils, cleaning supplies, paints, etc.) present on the FHC and Richardson properties will be removed by the current tenants when the properties are vacated.

Lead Based Paint/Asbestos— Metals-containing (e.g., lead) coatings or asbestos-containing materials are present in both the FHC and Richardson building based on an asbestos and paint survey. The quantity of asbestos is small. Both buildings contain lead based paint, however, based on sampling and testing, the lead based paint materials do not exceed TCLP criteria. Therefore, these materials are not a hazardous waste.

Demolition Debris Disposal/Recycling—All non-regulated concrete, metals (steel beams, metal sheeting), and wood from the demolished buildings will be recycled at local facilities. Non-hazardous concrete will be sent to a recycler where it will be crushed and sold as construction fill. Metal will be reused as is or recycled. Wood will be sent to a recycler where it will be shredded and burned for energy recovery.

Items such as gypsum wallboard and fiberglass insulation cannot be recycled and will be disposed of as solid waste at a local landfill.

The estimated volume of concrete that will be generated during demolition is 580 cubic yards (cy) for the FHC Building and 450 cy for the Richardson Building (1,030 cy total). This volume estimate is based on the total area of the FHC Building's CMU walls multiplied by the thickness of the CMUs (8 inches) and the total square footage of the building foundations multiplied by an assumed average foundation thickness of 1 foot. The 1-foot thickness is an average of the 6-inch-thick floor slabs and the concrete spread footings (the dimensions of which are currently unknown). The concrete volume estimate also includes concrete from; 1) a machine foundation in the Richardson Building with dimensions of 10 feet by 20 feet by 4 feet (assumed) and 2) a concrete slab at the northeastern bay door of the Richardson Building with dimensions of 30 feet by 50 feet by 0.5 feet (assumed).

## 5.2 ISRM WALL

### 5.2.1 Description of Work

The ISRM treatment wall will be installed by injecting an iron reductant into the soil to react with the native iron. The wall will extend east to west and will be located immediately south of the Richardson Metals Building. The alignment of the ISRM is based on groundwater data collected during the RI (Dames and Moore 1987) and groundwater sampling performed in the 1990's (URS-Greiner 1999).

Injection wells 6 inch in diameter will be installed along the alignment of the ISRM wall. Sodium dithionite (stored in tanker trucks) will be mixed with water to a specified concentration, injected into the wells, and left to react for a specified period of time (approximately 18 hours). After the reaction time has been attained, the reductant will be pumped from the wells along with a specified number of groundwater pore volumes.

### 5.2.2 Design Assumptions

<u>Injection Points</u>—The wall will consist of a single line of injection points. The injections will be located to provide contact between the injected reductant. This approach has been used in the past by Battelle on the Hanford site with good success. No breakthrough of the wall using this approach has been observed.

Based on pilot scale studies performed at the FHC site, two injection points at differing depths will be required at each location to account for the layer of low permeability soil underlying the clay layer. A total of 7 injection locations requiring 14 injection points (wells) will be required.

<u>Injection Radius of Influence</u>—Based on the tracer test and pilot test, it is estimated that the radius of influence of a single injection will be approximately 15 to 20 feet. Therefore, the injection locations for the wall will be spaced approximately 30 to 35 feet apart to provide approximately 15% (5 feet) overlap.

<u>ISRM Wall Depth</u>—Based on previous groundwater sampling and sampling performed to support design, the depth of the ISRM wall required to capture groundwater exceeding 5,000 μg/L hexavalent chromium is approximately 35 feet.

<u>Wall Alignment</u>—The ISRM wall will be located south of the Richardson Building and north of Cassidy Manufacturing. The wall will be carefully located to optimize the capture of groundwater exceeding 5,000 μg/L while minimizing the walls location on Cassidy property. The proposed alignment is shown in Figure 2. This alignment is based on the groundwater investigation performed in 1999 (URS Greiner 1999) and has been corroborated by the groundwater investigation performed by EPA-ESAT in May 2002 to support remedial design.

<u>Concentration of Reductant</u>—The reductant (sodium dithionite) will arrive in tanker trucks and be mixed with water prior to injection. The injected concentration of sodium dithionite will be approximately 0.07 moles per liter based on bench scale and pilot testing results.

<u>Volume of Reductant</u>—The quantity of concentrated reductant needed (prior to mixing with water) for each injection is approximately 6,000 gallons which will be mixed with 34,000 gallons of water to form 40,000 gallons of solution. The total volume of concentrated reductant needed for each injection location is approximately 40,000 gallons; the total quantity of solution needed for seven injections is approximately 280,000 gallons.

<u>Extraction of Reductant and Disposal Method</u>—Removal of the reductant after injection will be performed. Extraction fluids will be disposed in the City of Vancouver's sanitary sewer system. It is estimated that one pore volume will be extracted from each injection location. Approximately 300,000 gallons of fluid will be extracted and disposed.

## 5.3 SOURCE AREA TREATMENT

<u>Description of Work</u>—A chromium reducing agent will be augured into the soil, silt layer, and saturated zone to convert hexavalent chromium to trivalent chromium. The process of mixing the reagent with soil will be accomplished using specialty deep soil mixing equipment commercially available. The depth of mixing is based on the depth of groundwater exceeding 5,000 μg/L hexavalent chromium and soil exceeding 19 mg/kg.

After the soil is treated for chromium, a cement slurry will be mixed with the soil to give it adequate strength for building construction.

### 5.3.1 Design Assumptions

Depth of Impacted Groundwater—Groundwater exceeding the cleanup level of 5,000 µg/L is estimated to extend to a depth of 33 feet. The depth is based on groundwater samples collected during groundwater investigations performed to support design. Details regarding sample collection and analyte concentrations can be found in the Data Acquisition Report (Weston 2002a).

Area of Treatment—Figure 3 shows hexavalent chromium concentrations in silt and the proposed area and depth for in-situ treatment. The distribution and concentration of chromium in fill is similar to that in silt.

The area to be treated consists of soil exceeding 19 mg/kg hexavalent chromium. Based on sampling conducted during the RI and in 1999 (URS Greiner 1999), an area of approximately 27,000 square feet will be treated. As stated above, this treatment area will not address all soil exceeding 19 mg/kg. There will be a small volume outside the treatment area that will exceed 19 mg/kg. However, any groundwater impacts from this soil will be captured by the ISRM treatment wall located downgradient.

Depth of Treatment—Soil will be treated to a depth varying from 20 to 33 feet. This depth is based on the depth of groundwater exceeding 5,000 µg/L hexavalent chromium and soil exceeding 19 mg/kg.

Soil exceeding 19 mg/kg is primarily limited to the fill and silt layers; the depth of soil exceeding 19 mg/kg is estimated at 20 to 25 feet. Therefore, the impacted groundwater is the deciding factor in the determination of soil treatment depth.

Volume of Soil Treated and Treatment Rate—It is estimated that approximately 22,000 cubic yards of soil will require treatment. This estimate is based on an area of 27,000 square feet and an average depth of 22 feet (depth varies from 20 feet to 33 feet). Typical soil mixing equipment can treat up to 400 cubic yards of soil in one shift per rig.

Reductant—Based on treatability tests, ferrous sulfate or HydroBlend (mfg. Olin Chemical Corporation) will be used as the reductant (Weston 2002b). The selection of the reductant will be left to the Source Area Treatment Subcontractor.

Mass of Reductant—Based on treatability tests, a typical reagent (ferrous sulfate heptahydrate) addition rate of 3 wt % (i.e., 3 lbs ferrous sulfate heptahydrate/100 lbs of soil) will be mixed with soil to reduce the hexavalent chromium (Weston 2002b). The solution will be mixed at a rate of approximately 50 gallons per cubic yard of soil. It is estimated that a total of 1,300,000 gallons of reductant solution will be required to treat 22,000 cubic yards of soil.

Post Treatment Soil Strength Requirements—It is assumed that some minimal strength will be required of the soil to support light construction. Therefore, it is planned to add cement to the soil after treatment with reductant. A soil strength requirement of 30 lbs/square inch will be specified. This will require approximately 5 to 10 wt% cement to be added to the soil.

Significant construction at the site will require the constructor to install piling to support heavy loads.

Fluff Factor—Mixing reductant with soil using augers causes an increase in soil volume known as fluff. Based on similar projects, fluff is estimated at approximately 50% for soil in the vadose zone and 15% for soil in the saturated zone. Assuming a vadose zone depth of 20 feet, the treated area will experience a rise in elevation of approximately 8 feet which is equal to approximately 8,000 cubic yards. This soil is more than can be left onsite, therefore, the excess soil will be hauled to a Subtitle D landfill and disposed.

Site Elevations—Site elevations after soil treatment and fluff disposal will be approximately equal to those before treatment.

## 6. ARARS, PERMITS, CODES AND STANDARDS

Applicable or Relevant and Appropriate Requirements (ARARs)—ARARs have been developed and evaluated with regard to the remedy selected in the ROD. Design of the remedy will incorporate the appropriate engineering and monitoring controls to ensure compliance with ARARs. Appendix A contains a listing of ARARs and methods used to comply with these ARARs.

Codes and Standards—Codes and Standards will be followed. Based on the type of work performed, codes and standards that apply will consist of: National Fire Protection Association standards (storing flammable materials), National Electrical Code (temporary power), American Society of Testing and Materials (compaction testing, sieve testing, soil moisture content determinations, and other construction related test methods), EPA Standards (analytical methods), Occupational Safety and Health Administration standards and Washington Industrial Safety and Health Act standards.

Permitting Plan/Permits—The construction contractors (electrical, demolition, source area treatment, earthwork) will acquire any work permits needed. A grading permit may be required due to the quantity of soil disturbed. However, since this is a CERCLA site, permits are not required. The substantative requirements of a grading permit will be met, however, a permit issued by the governing agency will not be necessary to begin or complete the work. EPA and Weston will coordinate and inform the City of the scope of work to be performed prior to beginning construction.

EPA will acquire the waiver for installation of the test wells installed by the Geoprobe™ rig.

EPA will notify Ecology of the intent to inject a reductant into the aquifer to treat contaminated groundwater. Injection of a reductant has been approved by EPA and Ecology via the ROD. No additional permits (as required by the State Waste Discharge Program (WAC 173-216) or applications to inject the reductant into the groundwater will be obtained.

City permits and/or approvals will be obtained for appropriate work activities. These may consist of obtaining approval for discharge into the sanitary sewer and obtaining permits for performing work in roadways. Traffic control plans and permits will be required.

## 7. MINIMIZATION OF PUBLIC AND ENVIRONMENTAL IMPACTS

Public impacts and environmental impacts will be attained through engineering controls and monitoring. requirements for minimizing these impacts are discussed in the Site Management Plan (Weston 2002c).

## 8. OPERATIONS AND MAINTENANCE

Operations and Maintenance—There is no operation or maintenance required to support the remedy chosen for this site. The remedies are installed in a relatively short period of time and act passively.

Some minor maintenance may be required to repair damage to monitoring wells that occurs due to routine traffic over a period of years. Since it is likely that periodic monitoring will be required, an inspection of the monitoring wells should be performed at that time and maintenance performed appropriately. Figure 4 shows the location of both onsite and offsite wells which exist prior to remediation. (Note: several of these wells could not be found during remedial design site reconnaissance.) It is estimated that up to possibly 7 of the onsite wells will need to be abandoned prior to building demolition and source area treatment.

Monitoring—Operational and functional monitoring will be performed for approximately 1 year after the ISRM wall and source area soil is treated. After this monitoring is completed, long term monitoring will likely be performed by Ecology.

## 9. REFERENCES

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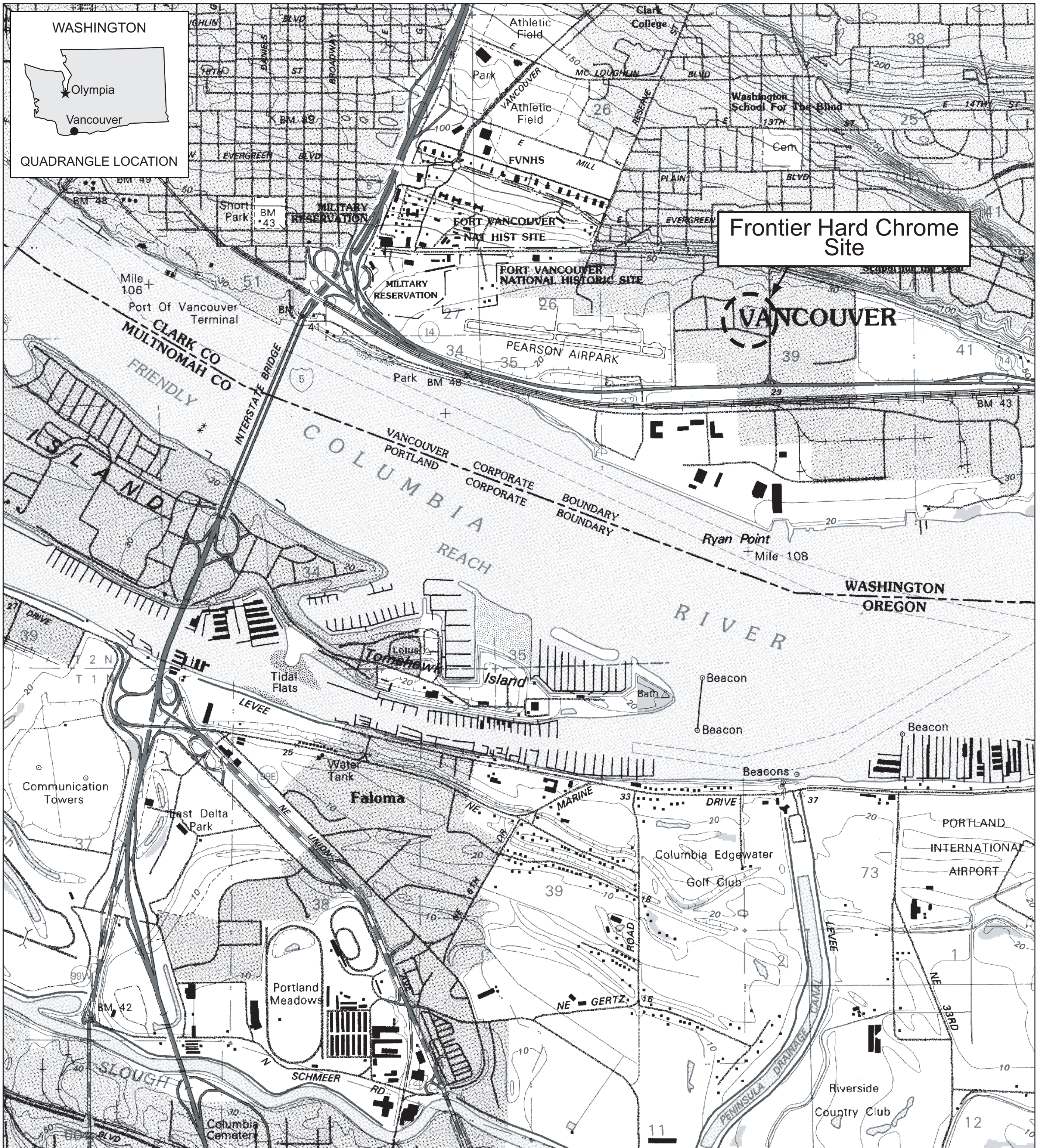
# FIGURES




# Frontier Hard Chrome—Vancouver, Washington
## Vicinity Map

0 1000 2000
Scale in Feet

WESTON SOLUTIONS

Figure
**1**

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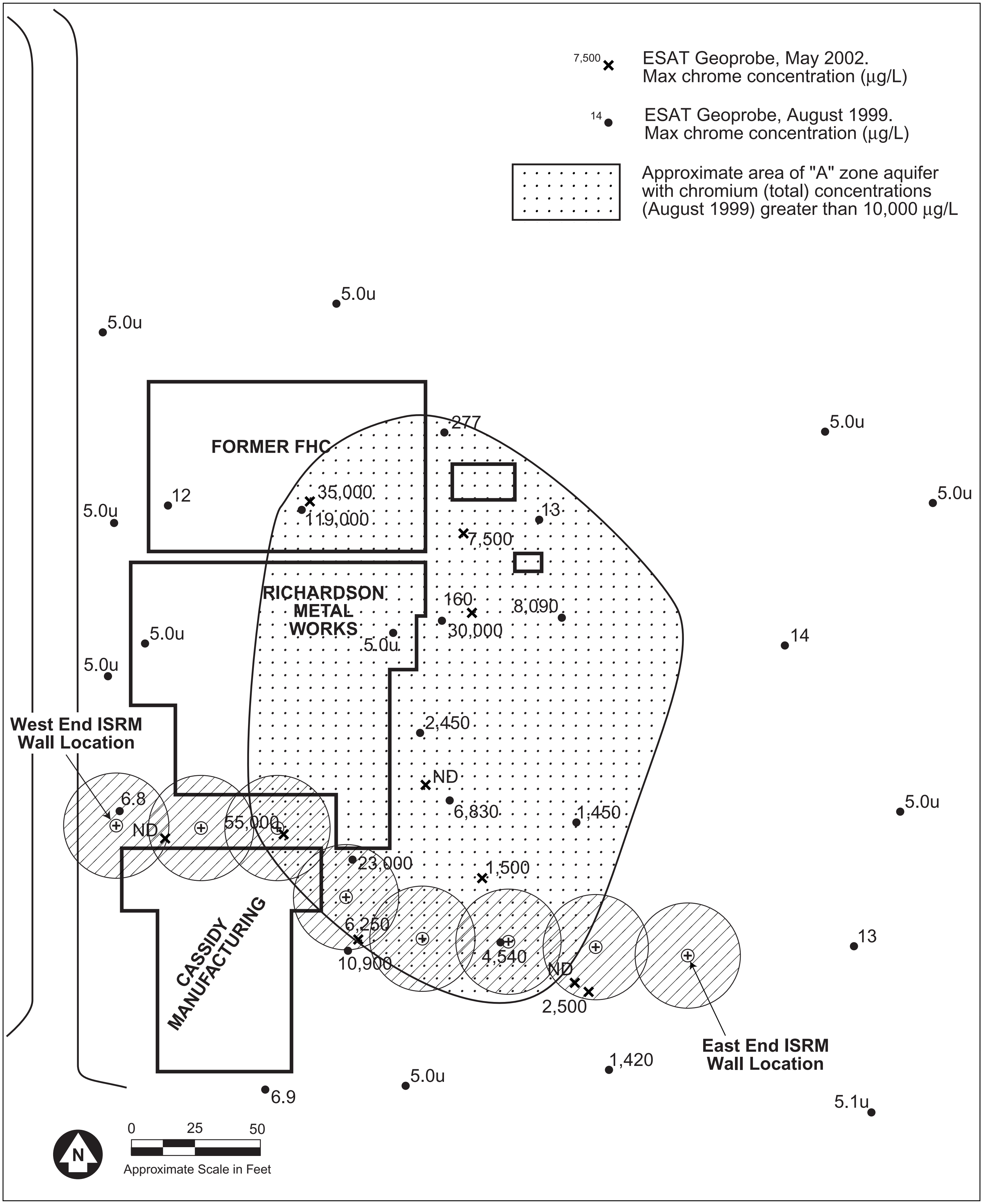


**Figure 2**
**ISRM Wall Alignment**

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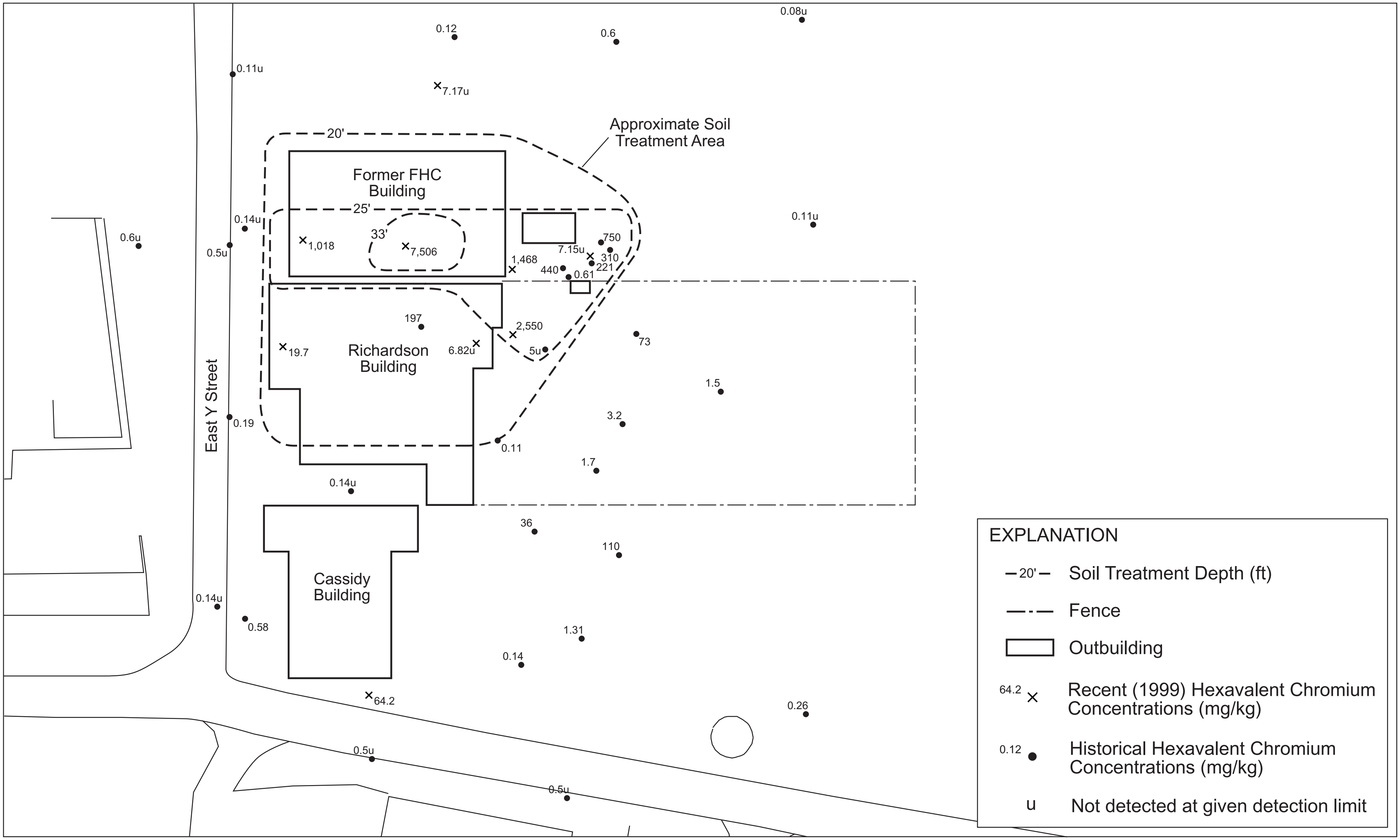
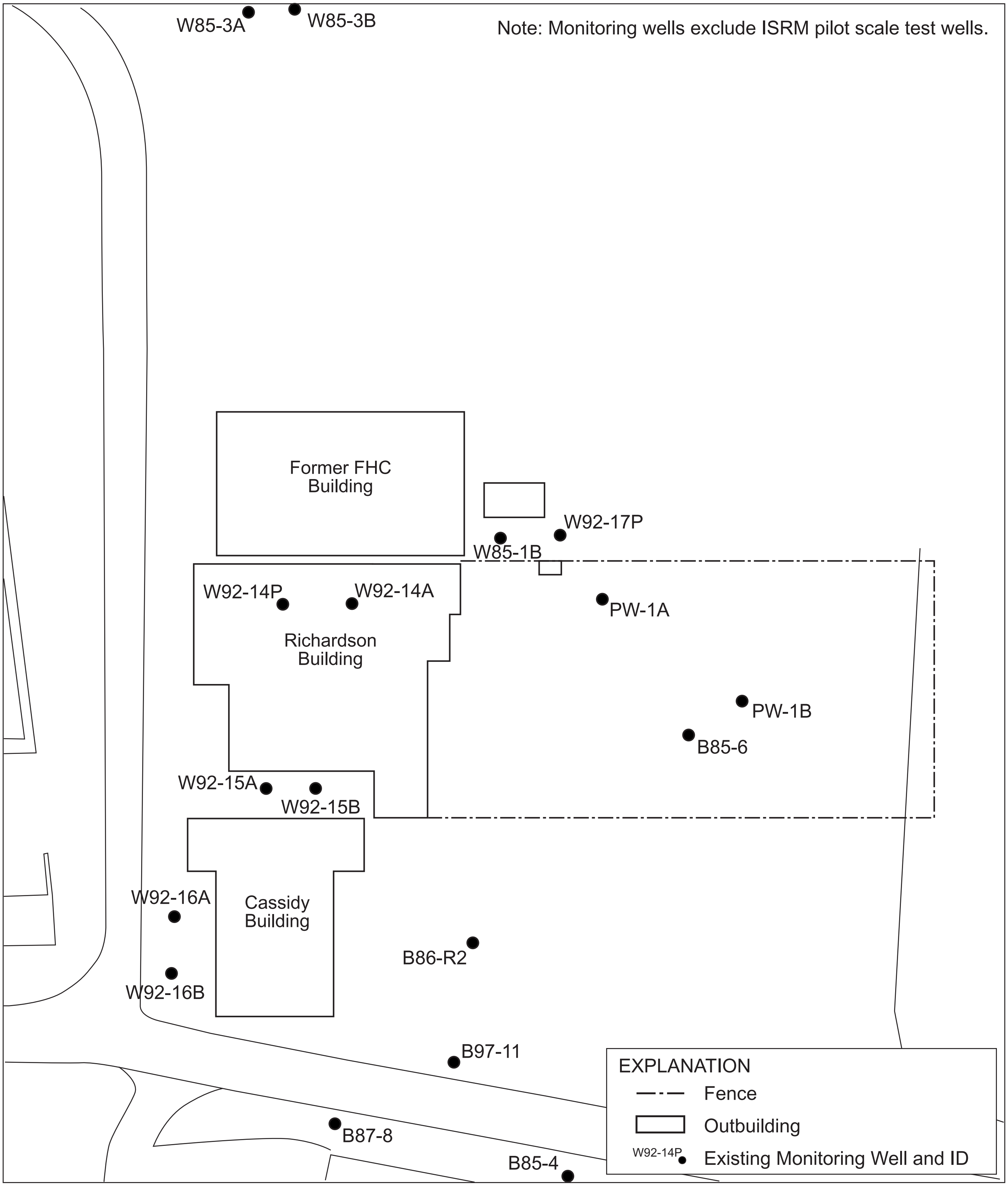



# Frontier Hard Chrome—Vancouver, Washington
# Concentrations of Hexavalent Chromium in Silt and Treatment Area

Figure
3

03-0018 Fig3.ai




0 20 40
Scale in Feet

# Frontier Hard Chrome—Vancouver, Washington
# Onsite Existing and Historical Monitoring Well Locations

Figure
**4**

WESTON SOLUTIONS

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# APPENDIX A

# COMPLIANCE WITH ARARS

## Chemical-Specific ARARs

| Medium/ Requirements | Standard/Criterion | Prerequisite | Citation | Comments |
|---|---|---|---|---|
| Washington State Clean Air Act (70.94 RCW) | State implementation of ambient air quality standards.<br>SWAPCA ambient and emission standards. | Point source or other defined emission source. | General Requirements for Air Pollution Sources (WAC 173-400) | The chosen remedy uses no exsitu active treatment of soil or groundwater. The processes chosen (in-situ reduction) will not result in air releases. |
| Safe Drinking Water Act (SDWA) | SDWA National Primary Drinking Water Standards: Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), Proposed MCLs and MCLGs. | Aquifer has potential to be used as drinking water source. | 40 CFR 141 | Treatability testing will quantify the potential to mobilize metals in groundwater and the process will be designed to minimize mobility. Cement or flyash used to stabilize soil for construction purposes will raise the pH and tend to immobilize metals. |
| Resource Conservation and Recovery Act (RCRA) (42 USC 7401-7642; 40 CFR 260-280) | Federal standards for identifying and managing hazardous wastes. | Meets threshold levels for TCLP. | Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste (40 CFR 261.24.10-11 Subpart B) | The chosen remedy may result in contaminated concrete that is a characteristic waste. This concrete will be tested and disposed appropriately. Contaminated soil may also need to be disposed off-site. It will also be tested for characteristic properties. |
| Washington Dangerous Waste Regulations (WAC 173-303) | State criteria for dangerous waste, which are broader than federal criteria. | Meets threshold levels for TCLP and carcinogenic compounds. | Designation procedures (Section -070) | The chosen remedy may result in contaminated concrete that is a characteristic waste. This concrete will be tested and disposed appropriately. Contaminated soil may also need to be disposed off-site. It will also be tested for characteristic properties. |
| Federal Water Pollution Control Act/Clean Water Act (CWA) (33 USC 1251-1376; 40 CFR 100-149) | Ambient water quality criteria for the protection of aquatic organisms and human health. | Discharge to surface water body. | 40 CFR 131 | No discharges to surface water are anticipated from the remedial action. The chosen remedy's goal is to treat groundwater to AWQCs before it reaches the river. Monitoring will ensure AWQCs are not exceeded at the point of compliance. |
| Washington Water Pollution Control Act - State Water Quality Standards for Surface Water (RCW 90.48) | State water quality standards; conventional water quality parameters and toxic criteria. | Discharge to surface water body. | WAC 173-201-045, -047 | No discharges to surface water are anticipated from the remedial action. The chosen remedy's goal is to treat groundwater to AWQCs before it reaches the river. Monitoring will ensure AWQCs are not exceeded at the point of compliance. |
| Model Toxics Control Act (WAC 173-340) | Requirements for establishing numeric or risk-based goals and selecting cleanup actions. | State hazardous waste site. | Groundwater (Section 720)<br>Surface Water (Section 730) | Cleanup goals and objectives to comply with MTCA were developed in the ROD. The remedy will be designed to meet these objectives. |

**Action-Specific ARARs**

| Actions | Requirement | Citation | Comments |
|---|---|---|---|
| Discharge to POTWs (Publicly Owned Treatment Works) | Contaminated water must be pretreated to certain limits prior to discharge. | National Pretreatment Standards (40 CFR 403); Local District Wastewater Discharge Ordinance | Discharges will be compliant with the POTW requirements. The City will be contacted and requirements obtained. Water will be periodically tested. |
| Discharge to surface water | Federal, non-enforceable criteria for water quality to protect human health and aquatic life. | Federal Water Quality Criteria (40 CFR 131) | No discharges to surface water are anticipated from the remedial action. The chosen remedy's goal is to treat groundwater to AWQCs before it reaches the river. Monitoring will ensure AWQCs are not exceeded at the point of compliance. |
| | State Water Quality Standards for Surface Water. | WAC 173-201-045, -047 | No discharges to surface water are anticipated from the remedial action. The chosen remedy's goal is to treat groundwater to AWQCs before it reaches the river. Monitoring will ensure AWQCs are not exceeded at the point of compliance. |
| Extraction/reinjection | Regulations and standards for the underground injection of hazardous waste and treated groundwater. State standards for discharges to surface water or reinjection. | Underground Injection Control Regulations (40 CFR 144-147; WAC 173-216, -218, -220;RCW 90.03, 90.14) WAC 173-154 Protection of Upper Aquifer Zone State Water Code and Water Rights | No wastes will be injected into the aquifer. No permit under the State Waste Discharge Permit Program is required. |
| Treatment, storage, or disposal of hazardous wastes | Effective November 8, 1988, disposal of contaminated soil or debris is subject to land disposal prohibitions or treatment standards. | 40 CFR 268 Federal Land Disposal Restrictions; WAC 173-303-140, -141 Land Disposal Restrictions | The chosen remedy may result in contaminated concrete that is a characteristic waste. This concrete will be tested and disposed appropriately. Contaminated soil may also need to be disposed off-site. It may also be tested for characteristic properties. |
| Storage or disposal of solid wastes | Requirements for solid waste management. | Solid Waste Disposal (Act 42 USC Sec. 3251-3259,6901-6991), as administered under 40 CFR 257, 258 Minimum Functional Standards for Solid Waste Handling (WAC 173-304) | The chosen remedy will result in debris that will need to be disposed. This material will be non-hazardous. It is anticipated that this material will be cleaned and recycled to the extent practical. Porous materials such as concrete will be tested before recycling. |

**Action-Specific ARARs**

| Actions | Requirement | Citation | Comments |
|---|---|---|---|
| Air emissions | National Primary and Secondary Ambient Air Quality Standards (NAAQS) for carbon monoxides, lead, nitrogen dioxide, particulate matter ($PM_{10}$), ozone, and sulfur oxides emissions from a "major" source. | Clean Air Act, Section 109; 40 CFR 50 | Emissions from site not expected to qualify as major source because: a) emissions will be less than 100 tons/year; b) emissions of a specified air contaminant will not occur. It is anticipated that the only emissions from the site that will occur will consist of dust and vehicle exhaust gasses. Dust will be monitored and controlled. Vehicle emissions are incidental. |
| Air Emissions | Regional ambient air quality standards applicable to regulated air contaminant. | Southwest Air Pollution Control Agency (SWAPCA) Regulation | Emissions from site not expected to qualify as major source because: a) emissions will be less than 100 tons/year; b) emissions of a specified air contaminant will not occur. It is anticipated that the only emissions from the site that will occur will consist of dust and vehicle exhaust gasses. Dust will be monitored and controlled. Vehicle emissions are incidental. |
| | National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Industrial Emissions. | Clean Air Act National Emissions Standards for Hazardous Air Pollutants NESHAPs), 40 CFR 61; WAC 173-400-075 State Emission Standards for Hazardous Air Pollutants | No hazardous air pollutants will be generated from the remedy chosen for implementation. All treatment will occur underground. |
| Air Emissions | New Source Pretreatment Standards applicable to new source of hazardous air pollutants. | 40 CFR 60 | No hazardous air pollutants will be generated from the remedy chosen for implementation. All treatment will occur underground. |
| | Controls for New sources of Toxic Air Pollutants for emission of any Class A or Class B toxic air pollutant (identified in WAC 173-460-150 through - 160) into ambient air. | WAC 173-460 | No hazardous air pollutants will be generated from the remedy chosen for implementation. All treatment will occur underground. |
| | Regional Emission standards for Toxic Air Pollutants. Source of toxic air contaminant requires a notice of construction. | SWAPCA Regulation | No hazardous air pollutants will be generated from the remedy chosen for implementation. All treatment will occur underground. |
| | Regional Emission Standards for fugitive dust. BACT to control dust. | SWAPCA Regulation | Dust will be controlled through implementation of engineering controls. Dust will be controlled to a target concentration of one-half OSHA (2.5 ug/m$^3$. |

**Action-Specific ARARs**

| Actions | Requirement | Citation | Comments |
|---|---|---|---|
| Occupational Safety | Safety Regulations, Protection of Workers | WAC 296-62<br>OSHA 1910.120 | HAZWOPER training will be required and site safety meetings held. A site safety plan will be prepared. |
| Transportation of Hazardous Materials | Regulates the transportation and shipping of hazardous materials | 49 CFR 100, -177<br>WAC 446-50 | Transportation of hazardous materials will be performed through the use of licensed carriers qualified for such transport. |
| Licensing of Well Drillers and Contractors | Requires all well drillers, geoprobe installers and other similar type operators to be licensed | WAC 173-162 Rules and Regulations Governing the Regulation and Licensing of Well Contractors and Contractors | Licensed well drillers will be used. In the case where the well driller is not licensed, a professional engineer will supervise the work. |
| Monitoring, extraction, recharge wells | Standards for construction, testing, and abandonment of water and resource protection wells. | WAC 173-160-010 through -303, -050 through -060 | Wells will be installed according to the requirements except for the 2 inch test wells. A waiver will be obtained for these wells. |
| Noise control | Maximum noise levels | Noise Control Act of 1974 (RCW 70.107; WAC 173-60) | Noise will be limited to 70 dBA at the property boundary. |

**Location-Specific ARARs**

| Location | Requirement/ Prerequisite | Citation | Comments |
|---|---|---|---|
| Within state siting criteria for waste management facilities | Siting criteria to be used as initial screen for consideration of solid or dangerous waste facility sites. | WAC 173-304<br>WAC 173-303-282(2)(b)(iii) | The remedy does not create a solid or dangerous waste facility. Soil and groundwater will be treated to non-hazardous conditions. |
| Habitat for fish, plants, or birds subject to state Fish and Game Department | Prohibits water pollution with any substance deleterious to fish, plant life, or bird life. | U.S. Fish and Wildlife Coordination Act (16 USC 661 et seq.) | The chosen remedy will be designed to be protective of the river. No pollution of the river will result as a result of implementing this remedy. |